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Executable examples for

COMIS 3.0

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1. Objective

The COMIS 3.0 – User's Guide provides the user with a lot of data about the program and its possibilities and limitations. The objectives of this paper is to give new COMIS users an introduction to the program and make them familiar with its environment by showing small executable examples and the output of the most common COMIS functions. Some similar but also other executable examples can be found in the final report* of Annex 23. Each part described in this paper has a footnote telling where to find the described part in the User's Guide. COMIS 3.0 allows the user to make the input in several different ways; the examples shown is just one way of doing it. Each section also shows what default values COMIS would use if no input data were provided.

2. COMIS basics

COMIS allows three different types of nodes to be specified by the user:
1. Zone of the building, which represents a room, a number of rooms or a connection between duct elements.
2. External node, which represents the conditions of the outside environment. The outside environment can be described by a single external node or by a number of external nodes.
3. Constant pressure zone; an artificial instrument to introduce a constant pressure in the network.

These units can be connected (linked) with each other by airflow components (links) such as cracks, fans, doors, flow controllers etc. The links between COMIS and the user are the COMIS input file (*.cif), written by the user or an interactive input program, and the COMIS output file (*.cof), the result of the simulation generated by COMIS. In the input file each part of the system (the building), schedules and conditions are specified under different data sections which all start with a & sign followed by a keyword. After the keyword line a header follows which tells the user about required input under this section. The header is not necessary for running the program, but it is convenient and helps the user. With the data following the header the user describes the building and its operational mode.

* Phaff, J.C., TNO report 96-BBI-R1086, Final Report Annex 23, Multi Zone Ventilation Models, Participation of TNO BOUW, Examples, 1996 July 29.

3. Description of zone input[1]

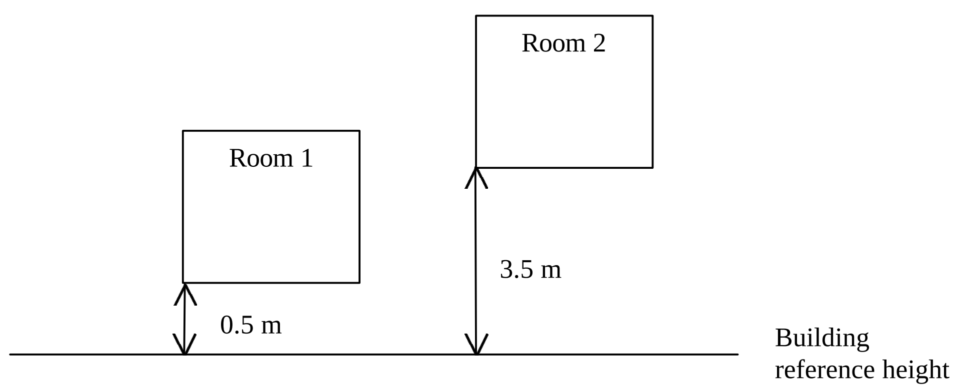
Zones are defined under **&-NET-ZON.**

This is an example of two zones in a building at different reference heights. No schedules are attached to these zones (for schedules please see 4.5, schedules). Room 1 is on the first floor, 0.5 m above building reference height, the room temperature is 19^{o}C, and the room volume is 60 m^3. Room 2 is on the second floor, 3 m above the floor in room 1, the temperature is 21^{o}C and its Height/Depth/Width ratios are 2.7/4/3. The zone's reference height does not have to be at floor level; it is up to the user where to set this height even though it most often makes it easier to have the reference height at the floor level. The header shows the default units. The units used are specified by the input given in the **&-PR-UNITS** section. The input will look like this since no schedules are connected to the zones and absolute humidity is not used for calculation of air density.

&-NET-ZONes

Zone ID (-)	Name [-]	Temp [C]	Ref. Height [m]	Vol [m3] H/D/W [m/m/m]	Abs. Hum ‡ [g/kg]	Schedule Name [T./H//]
R1	room1	19	0.5	60		
R2	room2	21	3.5	2.7/4/3		
Defaults						
-	-	20	0	50	0	-

Zone dimensions must be specified in the "volume" column if the zone is single-sided ventilated, has layers, or if C_d for large openings needs to be calculated. The input for constant pressure zones must be provided in **the &-NET-LINKS** section (see ex 1).



[1] U.G 5.4.3.1

4. Examples for network

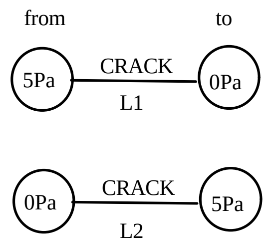
4.1 Example 1: Network with cracks[2] and constant[3] pressure zones

Cracks are described by the power law function: $\dot{m} = C_S \cdot \Delta p^n$

$\dot{m}$ [kg/s] C_S [kg/s@1Pa] Δp [Pa] n [-]

If there is any temperature influence (temperature difference between the zones) then C_S and n will be corrected accordingly.

Cracks are defined under the section **&-CR**. The filter section is described under the pollutant section, example 6. The crack input must start with `*CR`. The example describes two cracks of the same type connected (linked) between two constant pressure zones (5 and 0 Pa):



Definition of the crack:

&-CR **crack**

1.	Prefix and Name (-)	Description [-]
	*CR1	Crack between constant pressure zones

2. Cs (kg/s@1Pa)	Exp n (-)	Length [m]	Wall Properties Thickness [m]	U-value [W/m2 K]
0.003	0.667	d	d	d

3. Filter 1 (-)	Filter 2 [-]	Filter 3 [-]	Filter 4 [-]	Filter 5 [-]
0.0				

Defaults

-	-				
	0.001	0.65	1	0	0.3

[2] U.G 5.4.1.1
[3] U.G 5.4.4

0	0	0	0	0

If the default value (0.0) is used for the wall thickness then the temperature will be averaged between the both sides of the crack.

After the crack is defined it must be linked to the zones, which is done in the **&-NET-LINKS**[3] section. The crack (`CR1`) is the link (`L1`) between two zones (here with constant pressure), from a 5 Pa zone to a 0 Pa zone. The other link (`L2`) is the same crack but defined in the opposite direction and with a Factor/Actual of 2. This factor is being multiplied by the C_S value defined under the **&-CR** section and divided by the crack length defined in the same section (in this case the flow will be doubled since the default length 1 m is used in the crack input). $C_{Sused} = C_{Sdef} *\text{Factor}/\text{Length}_{def}$

The constant pressure zones are only defined in the section **&-NET-LINKS.** When "`d`" is entered in the input line the program will use the default values. The Own Height Factor is only used if a window is the link type. No schedules are attached to the link. The T-Junction and Reference Link are only used if the link is a duct (see example 2).

The link input will look like this:

&-NET-LINKS

Link ID (-)	Type Name (-)	Zone ID From (-)	Zone ID To (-)	Height From [m]	Height To [m]	Own Height Factor [-]	Factor/ Actual RPM/ Value [-]	3Dflow or Press [Pa]	Schedule Name (5 Char.) T-Junct. No [-]	Schedule Name (5 Char.) Ref. Link Angle [deg]
L1	CR1	5Pa	0Pa	d	d	d	d	d		
L2	CR1	0Pa	5Pa	d	d	d	2	d		
Defaults										
-	-	-	-	0	0	1	1	0	-	90

If the measurements performed to determine the crack input data (C_s and n) were made under other conditions than 20°C crack temperature, 101.320 kPa barometric pressure and 0 g/kg humidity the **&-NORMCR**[4] can be used to normalize the values.

Output

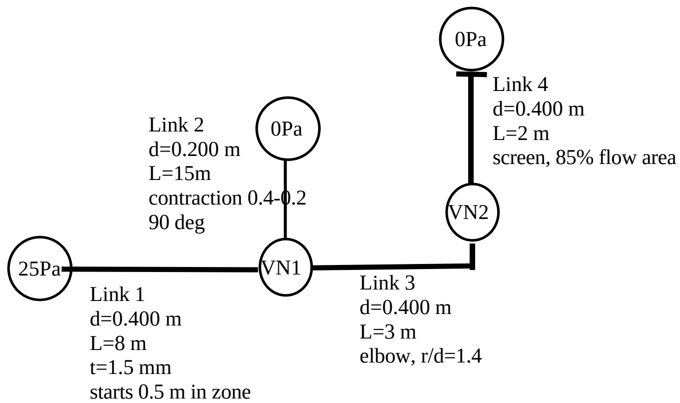
```
link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type    typ name  typ name     C       Pa         kg/s       kg/s
-------------------------------------------------------------------------------
  1    L1  CR1      sp 5Pa    sp 0Pa      20.   5.E+00    8.777E-03     0.E+00
  2    L2  CR1      sp 0Pa    sp 5Pa      20.  -5.E+00    0.E+00       1.755E-02
```

For this example, the output will give some COMIS error messages (*CER*) but the example will still run as intended and will provide a correct output. The first output line shows the data for link 1 (`L1`). The mass flow is written under `fma1`, which means that the direction of the flow is from the (5Pa) "from zone" to the (0Pa) "to zone". The mass

[4] U.G 5.4.1.1.1

flow for link 2 is written under `fma2`, therefore the mass flow is directed from the “to zone, (5Pa)” to the “from zone (0Pa)” and is also two times the mass flow in link 1.

4.2 Example 2: Network with ducts[5] and duct fittings



The input of the different parts of the system is made under the **&-DS** section. The different types that are available are shown in the user’s guide section 5.4.1.3.2. The input *DS”. To input a straight duct without any fitting just stop at the `Zeta` input in line two. The third line in the input for each duct is the filter section. The input of the system will look like this:

&-DS **duct straight**

1.	Prefix and Name (-)	Description [-]

2.	Ducts straight Part				one Fitting		
Diam1 (m)	Diam2 (m)	Rough (mm)	Lduct (m)	Zeta [-]	Type [-]	Param1 [acc t]	Param2 [acc t]
*DS1	entry round st. duct						
0.315	0	0.1	8	0	1	0.00375	1.25
0							
*DS2	contraction+duct						
0.315	0	0.1	15	0	8	0.25	90
0							
*DS3	elbow+duct						
0.315	0	0.1	3	0	6	1.4	
0							
*DS4	exit with screen						
0.315	0	0.1	2	0	5	85	
0							
Defaults							
-	-						
0.100	0	0.1	10	0	-	0	
0							
0							

5 U.G 5.4.1.3

To connect the different parts we need to specify zones that will be placed between the different components. In this case we need two zones, `VN1` and `VN2`. These are described in the **&-NET-ZONes**
section.
The input will look like this:

&-NET-ZONes

Zone ID (-)	Name [-]	Temp [C]	Ref. Height [m]	Vol [m3] H/D/W [m/m/m]	Abs. Hum ‡ [g/kg]	Schedule Name [T./H//]
VC1	vent_con	d	d	1		
VC2	vent_con	d	d	1		

In the **&-NET-LINKS** section the different parts are being linked together. `DS1` and `DS3` are the main ducts and `DS2` is the branch (90^{o} from the main duct) so `L2` and 90 is given at the `L1` input line. The input will look like this:

&-NET-LINKS

Link ID (-)	Type Name (-)	Zone ID From (-)	Zone ID To (-)	Height From [m]	Height To [m]	Own Height Factor [-]	Factor/ Actual RPM/ Value [-]	3Dflow or Press [Pa]	Schedule Name (5 Char.) T-Junct. No [-]	Schedule Name (5 Char.) Ref. Link Angle [deg]
L1	DS1	25Pa	VC1	d	d	d	d	d	L2	90
L2	DS2	VC1	0Pa	d	d	d	d	d		
L3	DS3	VC1	VC2	d	d	d	d	d		
L4	DS4	VC2	0Pa	d	d	d	d	d		

The length of a duct can be changed in the **&-NET-LINKS** section by giving the Factor/Actual a different value than 1 (default). The new length will be the factor to be multiplied by the length in the **&-DS** section. COMIS sometimes has problems with convergence if Tees are used (changing the **&-PR-CONTrol**[6] parameters “use old pressure” and “pressure initialization” might help in some cases).

Output

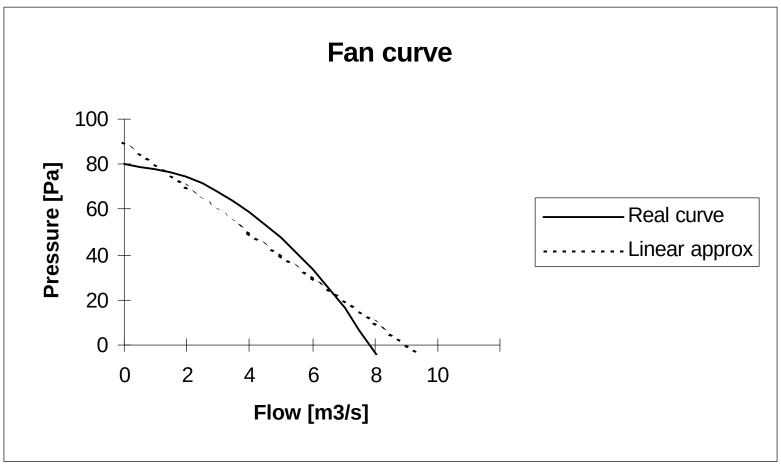
```
THE OUTPUT STARTS HERE!!
********************************************************************************

Input file:
ex2.cif
Model name:
Ducts
At time =  1900jan01_00:00:00    Monday  , interval =   0 seconds

  22 iterations with Solver=  5

================================================================================

Ventilation output
```

[6] U.G 5.2.3

```
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  VC1          9.604           0.3864               1.941E-05
  VC2          7.520           0.2856              -1.907E-06


 link                 from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
--------------------------------------------------------------------------------
   1 L1   DS1        sp 25Pa   zn VC1      20.  1.54E+01   3.864E-01     0.E+00
   2 L2   DS2        zn VC1    sp 0Pa      20.  9.74E-01   1.008E-01     0.E+00
   3 L3   DS3        zn VC1    zn VC2      20.  2.38E+00   2.856E-01     0.E+00
   4 L4   DS4        zn VC2    sp 0Pa      20.  7.52E+00   2.856E-01     0.E+00

COMIS finished. 1 timesteps.
```

4.3 Example 3: Network with fan[7]

This example shows how to input a known fan curve with data pairs and how to use a fan schedule.



Four points in the fan curve above were chosen to simulate this fan (line 4 in input). If the flag in input line two is set to 3 COMIS will use these points to calculate a polynomial curve approximation in the pressure range spanned by the input pressures in line 4. Since a polygonal fan curve approximation might oscillate outside the range of the spanned pressure a linear approximation (line 3 in input) has been made for data outside the region determined by data pairs.
C_S (0.003) and n(0.5) in line 2 describe the flow if the fan is off. `RhoI` (1.2) is the air density at the intake.

&-FA fan

[7] U.G 5.4.1.2

the last line is always the filter line

1.	Prefix and Name (-)	Description [-]

*FA1 Fan1

2.	# Flag:	1 = Polynomial input provided by **user** 2= Polynomial input calculated by **interface** from data pairs 3= Polynomial input calculated by **COMIS** from data pairs			
Flag (-)	Exp Polynom. (-)	RhoI (kg/m3)	NfI [rpm]	Cs [kg/s@1Pa]	Exp n [-]

3 3 1.2 1 0.003
0.5

3.	Pmin (Pa)	Pmax (Pa)	Slope (m3/s/Pa)	Intercept (m3/s)

0 90 0.1 9

4.	CO (m3/s)	C1 [m3/s/Pa]	C2 [../Pa2]	C3 [../Pa3]	C4 [../Pa4]	C5 [../Pa5]

d

5.	Fan Curve: Pressure Rise vs. Flow Rate, maximum 4 Lines Data Pairs: minimum 3 Pairs, maximum 12 Pairs				
(Pa)	(m3/s)	(Pa)	(m3/s)	(Pa)	(m3/s)

33 6 59 4 75 2
80 0

9.	Filter 1 (-)	Filter 2 [-]	Filter 3 [-]	Filter 4 [-]	Filter 5 [-]

d

Defaults
- -
1 5 1.2 1 0.5E-2 0.560
0 200 0.5E-3 0.1
0.1 -0.2E-3 -0.15E-5 0 0
0 0 0 0 0

A fan schedule is defined in the **&-SCH-FAN**[8] section. This provides the ability to vary the fan speed factor. If the fan speed in the curve above is 1000 rpm, then the values in the schedule will be 1400 (1.4*1000), 900 and 1400 rpm. The calculations of the new curve will be made according to the fan laws. The schedule name is `FA1S` and the input must start with a *.

&-SCH-FAN schedules

[8] U.G 5.5.4

Schedule*Name (-)	Time (-)	Fan Speed Factor (-)
*FA1S	1997jan02_06:00:00	1.4
	1997jan02_18:00:00	0.9
	1997jan03_06:00:00	1.4

To see the fan performance we connect the fan with two different constant pressure zones, 0Pa and 33Pa in case number one, and between 0Pa and 60Pa in case number two. This is defined in the **&-NET-LINKS** section**.** The fan schedule (`FA1S`) here is only attached to link number 1(`L1`).

&-NET-LINKS

Link	Type	Zone ID		Height		Own Height	Factor/ Actual RPM/	3Dflow or	Schedule Name (5 Char.)	
									T-Junct.	Ref. Link
ID	Name	From	To	From	To	Factor	Value	Press	No	Angle
(-)	(-)	(-)	(-)	[m]	[m]	[-]	[-]	[Pa]	[-]	[deg]
L1	FA1	0Pa	33Pa	d	d	d	1	d	FA1S	
L2	FA1	0Pa	60Pa							

Since we are now dealing with a simulation that varies over time, COMIS must know the start and stop time of the simulation. This is defined in the **&-PR-SIMUlation options**[9] section. In this example the simulation will start one hour before the schedule starts. the word “`VENT`” must be entered in the input (using the ventilation model).

&-PR-SIMUlation options

Simulation Option Keywords: One keyword per line Keywords may be preceded by “NO”		
VENT:ilation CONC:entrations SCHED:time <time> START:time	POL:lutant INPUT echo DEFAULT echo SET echo UNIT	HEAT:flow‡

VENT
START 1997jan02_05:00:00
STOP 1997jan06_06:00:00

Output

```
THE OUTPUT STARTS HERE!!
*****************************************************************************

Input file:
ex3.cif
At time =  1997jan02_05:00:00  Thursday  , interval =   3600 seconds
```

[9] U.G 5.2.2

```
  0 iterations with Solver=  5

===============================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
---------------------------------------------------------


 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1   FA1        sp 0Pa    sp 33Pa     20.  -3.3E+01   6.029E+00     0.E+00
   2 L2   FA1        sp 0Pa    sp 60Pa     20.   -6.E+01   3.937E+00     0.E+00
*******************************************************************************

Input file:
ex3.cif
At time =  1997jan02_06:00:00  Thursday  , interval =   43200 seconds

  0 iterations with Solver=  5

===============================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
---------------------------------------------------------


 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1   FA1        sp 0Pa    sp 33Pa     20.  -3.3E+01   1.012E+01     0.E+00
   2 L2   FA1        sp 0Pa    sp 60Pa     20.   -6.E+01   3.937E+00     0.E+00
*******************************************************************************

Input file:
ex3.cif
At time =  1997jan02_18:00:00  Thursday  , interval =   43200 seconds

  0 iterations with Solver=  5

===============================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
---------------------------------------------------------


 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1   FA1        sp 0Pa    sp 33Pa     20.  -3.3E+01   4.918E+00     0.E+00
   2 L2   FA1        sp 0Pa    sp 60Pa     20.   -6.E+01   3.937E+00     0.E+00
*******************************************************************************

Input file:
ex3.cif
At time =  1997jan03_06:00:00    Friday  , interval =   43200 seconds

  0 iterations with Solver=  5

===============================================================================

Ventilation output
```

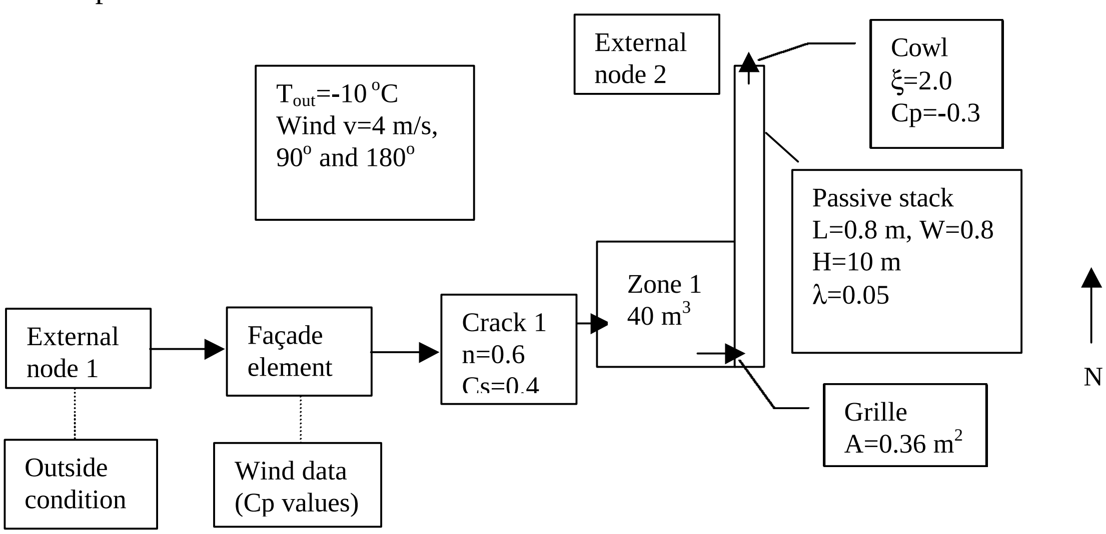
```
==================

 Zone-ID       pressure        totalflow          imbalance
               Pa              kg/s               kg/s
------------------------------------------------------------

 link                    from      to        Tlink  Dp-link      fma1       fma2
 nr    name type         typ name  typ name  C       Pa         kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1    FA1          sp 0Pa    sp 33Pa     20.  -3.3E+01   1.012E+01     0.E+00
   2 L2    FA1          sp 0Pa    sp 60Pa     20.    -6.E+01   3.937E+00     0.E+00
*******************************************************************************
```

Since no schedule is attached to `L2`, the output for this link is the same for each time step. When comparing the results with the factor/actual equal to 1.0, the actual fan curve shows that the calculated values are very close to those given by the fan curve. Note that the output is in m^3/s and not in kg/s

4.4 Example 4: Network with passive stack[10] and connections to the outside

The passive stack is a link from a zone in a building to the outside (outlet at the roof). An external node must be connected to a façade, which will provide Cp values for wind pressures.

Example:



First we define the passive stack under the key word **&-PS**.

```
&-PS        Passive Stack and a Cowl to be mounted from inside to outside  xx
  ______________________________________________________________
 |1.|                 |                                          |
 |__| Prefix + name   |    Description                           |
 |         (-)        |        [-]                               |
 |____________________|__________________________________________|
  ____________________________________________________________________________________
 |2.|          |           |           |           |           |           |           |
 |__|Area      | duct      | duct      | duct      | duct fr.  | cowl      | cowl      |
 |of grille    | diameter  | diameter  | length    | Lambda      zeta      | Cp        |
 |    (m2)     |    (m)    |   (m)     |   (m)     |   [-]     |   [-]     |  [-]      |
 |_____________|___________|___________|___________|___________|___________|___________|
  ____________________________________________________________
 |3.|Filter 1    |Filter 2   |Filter 3   |Filter 4   |Filter 5   |
 |__|   (-)      |   [-]     |   [-]     |   [-]     |   [-]     |
```

[10] U.G 5.4.1.3.3

```
 |______________|__________|__________|__________|__________|

*PSsq         squared duct
  0.36           0.8         0.8        10        0.05         2       -0.3
  0
```

Defaults
\- -
0.01 0.02 0.02 5 0.05 2.5 -0.35
0

The crack is defined as shown in example no 1.

```
&-CR        CRACK                   6

*CR1          outdoor
 0.4            0.6       1          d          d
 0
```

The zone is specified as shown in earlier examples.

```
&-NET-ZONes                          18

    1    one              20       0        60               d
```

The two external nodes are specified and connected to the façade elements in the **&-NET-EXT**[11] section.

```
&-NET-EXTernal node data          21        --- OPTIONAL DATASECTION ---
  ____________________________________________________________
 |External Node No    | Facade Elem No     | Outside Conc Factor|
 |          (-)       |   (-)              | [-]                |
 |____________________|____________________|____________________|

  exn1                 1                    0
  exn2                 2                    0
```

The input of the Cp values for the façade elements is provided in the **&-CP-VALUes**[12] section and the reference height in the **&-CP-BUILding**[13] section**.**

```
&-CP-BUILding reference height for Cp data 32 - OPTIONAL DATASECTION ---
  __________
 | Height   |
 | (m)      |
 |__________|
  15
```

Defaults
10

```
&-CP-VALUes                          33        --- OPTIONAL DATASECTION ---
  _________________
 |1.|Dataset Name  |
 |__|______________|

 cp
  __________________________________________________________________________
 |2.|Facade  |   Wind Direction  (first line )                              |
 |__|Elem.no.|   Cp Values       (second and following lines)               |
 |  * (-)    |(deg) |[deg] |[deg] |[deg] |[deg] |[deg] |[deg] |[deg] |[deg] |
```

[11] U.G 5.4.3.4
[12] U.G 5.6.2
[13] U.G 5.6.1

```
 |__________|_____|_____|_____|_____|_____|_____|_____|_____|_____|

 *            0.0    90.0   180.0  270.0
 1           -0.4    0.5    -0.4  -0.35
 2             0       0      0      0
```

Defaults

	0	0	0	0
	0	0	0	0

The first line starting with a "*" provides the wind directions. The following lines provide the pressure distribution for each façade element at the given wind directions. The input of zeros in the line for façade element 2 will give the cowl an actual value of –0.3 in every wind direction (see input of Passive Stack).

The connections between outside and the internal zone via the crack as well as the internal zone and outside via the passive stack are defined in the **&-NET-LINks**[14] section.

```
&-NET-LINks                      22
 ____________________________________________________________________________________
 |Link|Type     | Zone ID |   Height    |Height|Act.  |3Dflow|Schedule Name(5char.)|
 |    |         |_________|_____________|      |      |  or  |_____________________|
 |    |         |    |    |      |      |      |      |      |T-Junct.  Ref.Link   |
 | No |Name     |From|To  |From  |To    |Factor|Val.  |Press |   No    |   Angle   |
 |(-) |(-)      |(-) |(-) |[m]   |[m]   | [-]  |[-]   | [Pa] |   [-]   |   [deg]   |
 |____|_________|____|____|______|______|______|______|______|_________|___________|

  L1   CR1       -exn1 1     0.5   0.5     d      d      d
  L2   PSsq       1    -exn2  0   10       d      d      d
```

The wind input is from a weather (meteo) station and might be applied to a building at a different height above sea level and with a different surrounding than the weather station. To make this transformation possible, the data of the weather station's height, wind velocity profile (alpha) at the weather station, building location, the surroundings and the velocity profile of the building location must be provided to the program. As shown in the picture of this problem the building angle north to the x-axis is zero degrees. Here is an example where alpha at the weather station is 0.14 and alpha at the building is 0.4:

```
&-ENV-BUIlding[15] related parameters  34       --- OPTIONAL DATASECTION ---
  ____________________________________________________________
 |1.|  Altitude|  Angle Building |   Geographic Position      |
 |__|          |_________________|____________________________|
 |             | North to-X-Axis |Latitude +=N | Longitude +=E|
 |      (m)    |   (deg)         | [deg]   -=S |  [deg]    -=W|
 |_____________|_________________|_____________|______________|

        600             0            55.717        12.567
```

Defaults

0	0	43	0

```
&-ENV-WINd[16] and meteo related parameters 35  --- OPTIONAL DATASECTION ---
  _________________________________________________________
 |1.|Ref. Height    |  Altitude         | Wind Velocity    |
```

[14] U.G 5.4.4.2
[15] U.G 5.7.1
[16] U.G 5.7.2

```
|__|for Wind Speed | Meteo Station      | Profile Exponent |
|     (m)          |  (m)               |   (-)            |
|__________________|___________________|__________________|
         10                800                    0.14
```

Defaults

10	0	0.14

```
 ____________________________________________________________
|2.| Wind        |             |     Wind        |                 |
|__| Direction|Plan Area   |Velocity Profile|  Surrounding    |
|     Angle    |Density      |    Exponent     |Buildings Height|
|    (deg)     |    (-)      |      (-)        |      (m)        |
|______________|_____________|_________________|_________________|
  0               d               0.4           d
 90               d               0.4           d
180               d               0.4           d
270               d               0.4           d
```

Defaults

0	0	0.14	0

The default values are used for “Plan Area Density” and “Surrounding Buildings Height” since the Cp value input is given and the program is not supposed to calculate the Cp values. The wind velocity exponent depends on the surroundings. The program calculates the wind speed at 60 m (860 m above sea level), assumes that the speed is the same 60 m above the building ground and then corrects the speed to 15 m because this is the reference level given in the input.

The Wind Velocity Profile Exponent can be given as either `alpha` or `z0`; in this case the input is given as `alpha` and defined under the **&-PR-UNITS** heading.

&-PR-UNITS[17]

```
 _______________________________
| Unit Conversion Definitions   |
| Name     |  Input    |  Output  |
|__________|___________|__________|

INPUT
profile      alpha
```

To simulate the flow in the passive stack during changing weather conditions a schedule (`*METeo`) for weather data is provided.

&-SCH-METeo[18] `data                 36        --- OPTIONAL DATASECTION ---`

```
 ________________
|1.|Dataset Name  |
|__|______________|

*METeo
 ______________________________________________________________________
|2.|Time                 |        Wind         |Temperature|Humidity|Barometric|
|__|                     |___________________|           |        |Pressure  |
|                        | Speed   |Direction|           |        |Absolute  |
|(-)                     |(m/sec) |(deg)    |(oC)       |[gr/kg] |[kPa]     |
```

[17] U.G 5.2.1.1
[18] U.G 5.7.3

```
 |____________________|________|_________|___________|________|__________|

  1997jan01_00:00:00    0        0         20          d        d
  1997jan02_00:00:00    2        0        -10          d        d
  1997jan03_00:00:00    4        90       -10          d        d
```

Defaults

Jan01_	0	0	20	0	101.325

Under **&-PR-SIMU** the program is told to start the simulation at 010197 (January 1, 1997), stop at 010297 (January 2, 1997), to start processing the schedule(s) at 010197 and to print out the ventilation results.

&-PR-SIMUlation options 3

```
  _________________________________________________________
 | Output Option Keywords:  One keyword per line            |
 |                          Keywords may be preceded by NO  |
 |__________________________________________________________|
 | VENT:ilation             POL:utant          HEAT:flow    |
 | CONC:entrations                                          |
 |                          INPUT echo                      |
 |                          DEFAULT echo                    |
 |                          UNIT                            |
 | SCHED:time<time>                                         |
 | START:time<time>[CONT|REUSE]    STOP:time<time>[KEEP]    |
 |__________________________________________________________|

VENT
SCHED 1997jan01_00:00:00
START 1997jan01_00:00:00
STOP 1997jan03_00:00:00
```

Output

```
********************************************************************************

Input file:default.cif
Model name:
Ex 4 Passive stack, external nodes and wind
At time =  1997jan01_00:00:00 Wednesday  , interval =       86400 seconds

           0 iterations with Solver=          5

================================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  1            0.000           3.251E-07           -6.502E-07


 link                 from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
--------------------------------------------------------------------------------
   1 L1   CR1        ex exn1   zn 1        20.    0.E+00*     0.E+00     0.E+00
   2 L2   PSsq       zn 1      ex exn2     20.  3.31E-12 # 6.502E-07     0.E+00

  50.0% (   1) of the (   2) links has Laminar flow, Indicated with Dp* .
Links indicated with 'Dp #' means:
The stack pressure of this link is an interpolation between
the stack pressure when the flow is positive and the value when
it is negative. This interpolation is necessary to prevent
convergence problems.

****** ERRORS IN INPUT DATA: **************

***CER*** SEVERE ***
```

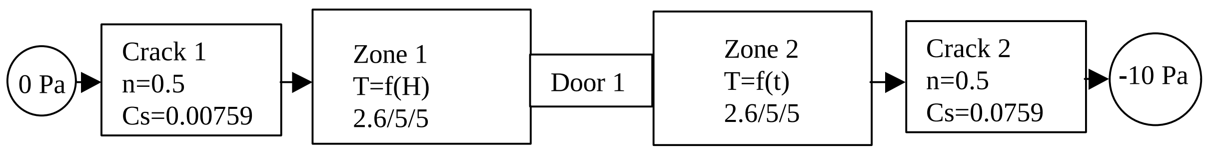
```
 Meteo Barometric pressure=101.325kPa.
 Value is more than 10kPa above expected 91.320877kPa !
----------------------------------------------------------------
********************************************************************************

Input file:default.cif
Model name:
Ex 4 Passive stack, external nodes and wind
At time =  1997jan02_00:00:00  Thursday  , interval =        86400 seconds

           5 iterations with Solver=          5

================================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  1           -4.203          0.6939              -2.822E-05


 link                 from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
--------------------------------------------------------------------------------
   1 L1   CR1        ex exn1   zn 1         5.  2.34E+00   6.939E-01     0.E+00
   2 L2   PSsq       zn 1      ex exn2     20.  4.05E+00 #  6.94E-01     0.E+00
Links indicated with 'Dp #' means:
The stack pressure of this link is an interpolation between
the stack pressure when the flow is positive and the value when
it is negative. This interpolation is necessary to prevent
convergence problems.
***CER*** SEVERE ***
 Meteo Barometric pressure=101.325kPa.
 Value is more than 10kPa above expected 91.320877kPa !
----------------------------------------------------------------
********************************************************************************

Input file:default.cif
Model name:
Ex 4 Passive stack, external nodes and wind
At time =  1997jan03_00:00:00    Friday  , interval =            0 seconds

           6 iterations with Solver=          5

================================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  1           -0.096          1.126                -9.65E-05


 link                 from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
--------------------------------------------------------------------------------
   1 L1   CR1        ex exn1   zn 1         5.  5.25E+00   1.126E+00     0.E+00
   2 L2   PSsq       zn 1      ex exn2     20.  1.02E+01 # 1.126E+00     0.E+00
Links indicated with 'Dp #' means:
The stack pressure of this link is an interpolation between
the stack pressure when the flow is positive and the value when
it is negative. This interpolation is necessary to prevent
convergence problems.
```

The output gives a warning about the barometric pressure because the building is located 600 m above sea level. The pressure used was the default value (101.325). Of course the flow is zero on 010197 because there are no driving forces (no wind and no temperature difference). The flow on 010397 is higher than the flow on 010297 because the wind is now creating a positive pressure at the crack (external node 1).

4.5 Example 5: Network with windows/doors[19], schedules and zone layers[20]

The object of this example is to show the input for an internal door, zone layers, and the use of zone temperature and door opening schedules.

Example:



Door 1 is 0.914 m wide and 2.13 m high. The flow through the closed door has been measured as 100 l/s at 75 Pa (20^{o}C) and the power law exponent is 0.55. The Cs input to COMIS is in kg/s@1Pa and per crack length.

Input Cs = $0.1*1.2/75^{0.55} * 1/(2*0.914+2*2.13) =$ 0.001834 kg/s@1Pa

The Cd values are a function of the height of the door and the height of the room (internal doors). By giving the input for Cd the value 0.0 the program will calculate the Cd values. A minimum of two opening fractions must be provided to make an interpolation between the fractions possible. The only cracks are those around the door, so the input at Lextra will be zero. The Large Vertical Opening (LVO) type is rectangular, or type 1. The door input is provided in the **&-WI** section.

```
&-WI       Window / Door          14
 ____________________________________________________________
 |1.|                |                                       |
 |__| Prefix + name  |    Description                        |
 |         (-)       |        [-]                            |
 |___________________|_______________________________________|
  *WI1  door between one and two
 ___________________________________________________________________
 |2.|Closed: Cs  | Expn      |LVO Type  |Lwmax      |Lhmax     |Type 1:   |
 |__|            |           |1=rectang |           |          |Lextra    |
 |               |           |2=horiz.  |           |          |Type 2:   |
 |               |           |piv. axis |           |          |Axisheight|
 |   (kg/s@1Pa)  |(-)        |(-)       |(m)        |(m)       |[m]       |
 |_______________|___________|__________|___________|__________|__________|
    0.001834         0.55        1         0.914      2.13      0
```

Defaults
0.1E-3 0.7 1 1 1 0

```
 ____________________________________________________________
 |3.|Opening     |CD         |Width     |Height     |Start Height|
 |__|Fraction    |Factor     |Factor    |Factor     |            |
 |    (-)        |[-]        |  [-]     | [-]       | [-]        |
 |_______________|___________|__________|___________|____________|
 0                  0          0            1          0
 1                  0          1            1          0
```

Defaults
0 0 1 1 0

[19] U.G 5.4.1.5
[20] U.G 5.4.3.2

```
 ____________________________________________________________
|4.|Filter 1   |Filter 2  |Filter 3  |Filter 4  |Filter 5  |
|__|   (-)     |   [-]    |   [-]    |   [-]    |   [-]    |
|______________|__________|__________|__________|__________|
0
```

In the **&-SCH-WIN**[21] section a schedule can be specified, providing the opening factor of the door at a certain time. Example: Let the door be closed when the simulation starts on 010197, open the door 10% (9^{o}C) at 010297 and 90% on 010397. In the **&-NET-LINk**s section the input for actual value will be zero, so the door is closed when the simulation starts.

```
&-SCH-WINdow schedules           25        --- OPTIONAL DATASECTION ---
 _________________________________________________________
|Schedule    |     Time                     | Opening Fraction   |
|*Name       |                              |                    |
| (-)        |     (-)                      |   (-)              |
|____________|______________________________|____________________|
*door1            1997jan02_00:00:00           0.1
                  1997jan03_00:00:00           0.9
```

The name of the schedule (door1) will be connected to the link at the &-NET-LINks section

The crack input is similar to earlier examples.

```
&-CR        CRACK                    6
*CR1   Crack one
 0.00759           0.5       1             d          d
 0
*CR2   Crack two
 0.0759            0.5       1             d          d
 0
```

The input of the two zones is similar to that of earlier examples, but this time a zone temperature gradient will be connected to zone 1 and a temperature schedule will be connected to zone 2. The `H/D/W` (height/depth/width) values must be provided for both zones, because the program is asked to calculate the Cd values for the door between the zones. The name of the temperature schedule (`temp2`) for zone 2 is given here.

```
 &-NET-ZONes                       18
 ________________________________________________________________________________
|Zone| Name              | Temp    |Ref.     |Vol              |Abs.     | Schedule |
| ID |                   |         | Height  |[m3]             | Hum     |  Name    |
|    |                   |         |         |H/D/W            |         |          |
| (-)| [-]               |  [oC]   |  [m]    |[m/m/m]          |gr/kg]   | [T./H..] |
|____|___________________|_________|_________|_________________|_________|__________|

  1    one                10        0         2.6/5/5          d
  2    two                20        0         2.6/5/5          d          temp2
```

The temperature given for zone 1 (10^{o}C) is at floor level. The gradient is 2.5^{o}C per meter the first meter and 1^{o}C per meter for the following 1.6 meters. The zone layer input is made under **&-NET-ZL.**

```
&-NET-ZL zone-layers             19        --- OPTIONAL DATASECTION ---
 ________________________________________________________________
|Zone    |Start   | Temp   | Hum.   | Poll.  |Volume  |Source  |Sink    |
|*ID     |Height  | Grad   | Grad   | Grad   |Fract.  |Fract.  |Fract.  |
|        |        |        |Factor  |Factor  |        |        |        |
| (-)    | (m)    |[oC/m]  | [-]    | [-]    | [-]    | [-]    | [-]    |
|________|________|________|________|________|________|________|________|
 *1        0        2.5      d        0        0.385    d        d
```

[21] U.G 5.5.3

```
         1       1      d       0       0.615    d      d
```

Defaults							
-	0	0	0	0	0	0	0

Let's change the temperature in zone 2 from 20°C to 15°C at 010397. This is implemented in the **&-SCH-TEM**[22] section**.**

```
&-SCH-TEMperature schedules       27        --- OPTIONAL DATASECTION ---
  ___________________________________________________________
 |Schedule   |    Time                   |    Temp             |
 |*Name      |                           |                     |
 | (-)       |    (-)                    |    (oC)             |
 |___________|___________________________|_____________________|
*temp2            1997jan03_00:00:00           15
```

In the &-NET-LINks section the zones and the constant pressures are connected and the door schedule (`door1`) is attached to the link between zone 1 and 2. The door is closed (`actual value` = 0) at the door link.

The **&-NET-LIN**ks section will look like this.

```
&-NET-LINks                        22
  ________________________________________________________________________________
 |Link|Type     | Zone ID |  Height    |Height|Act.  |3Dflow|Schedule Name(5char.)|
 |    |         |_________|____________|      |      |  or  |_____________________|
 |    |         |    |    |     |      |      |      |      |T-Junct.  Ref.Link   |
 | No |Name     |From|To  |From |To    |Factor|Val.  |Press |   No    |   Angle   |
 |(-) |(-)      |(-) |(-) |[m]  |[m]   | [-]  |[-]   | [Pa] |   [-]   |   [deg]   |
 |____|_________|____|____|_____|______|______|______|______|_________|___________|

  L1    CR1   0Pa   1    1      1     1     1       0
  L2    WI1   1     2    0      0     1     0       0     door1
  L3    CR2   2    -10Pa 1      1     1     1       0
```

The simulation and schedule time is specified as in example 4.

```
&-PR-SIMUlation options           3
VENT
SCHED 1997jan01_00:00:00
START 1997jan01_00:00:00
STOP 1997jan03_00:00:00
```

Output

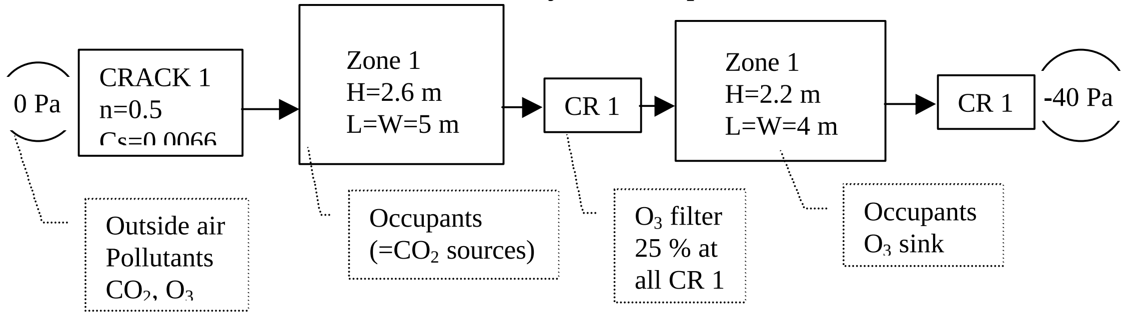
```
THE OUTPUT STARTS HERE!!
*******************************************************************************

Input file:default.cif
Model name:
Ex 5, windows and doors with sched.
At time =  1997jan01_00:00:00 Wednesday  , interval =       86400 seconds

           5 iterations with Solver=          5

===============================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
```

[22] U.G 5.5.5

```
  1           -6.625          0.02019             -1.142E-10
  2           -9.929          0.02019              1.078E-07

 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1   CR1        sp 0Pa    zn 1      16.25  6.99E+00   2.019E-02     0.E+00
   2 L2   WI1        zn 1      zn 2        10.   3.3E+00   2.019E-02     0.E+00
   3 L3   CR2        zn 2      sp -10Pa    20.  7.08E-02   2.019E-02     0.E+00
*******************************************************************************

Input file:default.cif
Model name:
Ex 5, windows and doors with sched.
At time =  1997jan02_00:00:00  Thursday  , interval =        86400 seconds

           8 iterations with Solver=           5

===============================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  1           -9.423          0.0239               3.012E-11
  2           -9.901          0.0239               9.132E-09

 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1   CR1        sp 0Pa    zn 1      16.25  9.79E+00    2.39E-02     0.E+00
   2 L2   WI1        zn 1      zn 2      12.72  4.78E-01    2.39E-02     0.E+00
   3 L3   CR2        zn 2      sp -10Pa    20.  9.91E-02    2.39E-02     0.E+00
*******************************************************************************

Input file:default.cif
Model name:
Ex 5, windows and doors with sched.
At time =  1997jan03_00:00:00    Friday  , interval =            0 seconds

           8 iterations with Solver=           5

===============================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  1           -9.532          0.02403               7.59E-10
  2           -9.696          0.02403              1.107E-08

 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1   CR1        sp 0Pa    zn 1      16.25   9.9E+00   2.403E-02     0.E+00
   2 L2   WI1        zn 1      zn 2      12.27  1.64E-01   2.403E-02     0.E+00
   3 L3   CR2        zn 2      sp -10Pa   17.5  9.94E-02   2.403E-02     0.E+00

COMIS finished. 3 timesteps.  There are no errors.
```

4.6 Example 6: Network with sink, source, filter and occupants

To illustrate to use of the pollutant model the following simple model with two zones connected to each other and to the outside by constant pressure nodes is shown:



By using the filter input (which can be used at any type of link) at the Crack section the concentration of pollutant number 2 (O_3) will decrease by 25% every time the air passes a link of the type "CR1".

Here follows the input for this part (without headers):

```
&-CR        CRACK                       6
   *CR1   Crack one
   0.0066           0.5       1            d         d
__________________________________________________________
|3.|Filter 1    | Filter 2 | Filter 3 | Filter 4 | Filter 5 |
|__|   (-)      |    [-]   |    [-]   |    [-]   |    [-]   |
|_______________|__________|__________|__________|__________|
        0          0.25
```

```
&-NET-ZONes                             18
   1    one              20       0        2.6/5/5          d
   2    two              20       0        2.2/4/4          d    SO3
```

```
&-NET-LINks                             22
   L1     CR1    0Pa    1    1      1     1     1       0
   L2     CR1    1      2    1      1     1     1       0
   L3     CR1    2     -40Pa 1      1     1     1       0
```

In this case two pollutants will be used. The definition of these is at the **&-POL-DEScription**[23] section.

```
&-POL-DEScription                       37        --- OPTIONAL DATASECTION ---
  ________________________________________
 | No  |Name                     |Molar Mass  |
 | (-) |(-)                      | (g)        |
 |_____|_________________________|____________|
    1         CO2                   44
    2         O3                    48
```

Defaults		
-	pollutantx	28.6

[23] U.G 5.7.4.1

The starting concentrations, sinks and sources in the two zones are given under **&-NET-ZP**[24]**.** The initial concentrations of CO_2 are the same as the outside air (0.0012 kg/kg). There is neither a sink nor a source of CO_2 in the zones. The first input line refers to pollutant number 1 and the second line to pollutant number 2. In zone 2 there is a O_3 sink (1.E-7 kg/s). The input unit for concentrations must be in kg/kg.

```
&-NET-ZP zone-pollutants         20        --- OPTIONAL DATASECTION ---
  ____________________________________________________________
 |Zone     |              Pollutant                           |
 |         |__________________________________________________|
 |  *ID    | Initial        |      Source            | Sink     |
 |         | Concentration  |                        |          |
 |  (-)    |    (kg/kg)     |      [kg/s]            | [kg/s]   |
 |_________|________________|________________________|__________|
   *1            0.0012        0.000000                0.000000
                 0.000000      0.000000                0.000000
   *2            0.0012        0.000000                0.000000
                 0.000000      0.000000                0.0000001
```

Defaults

- No defaults

To change the O_3 sink strength during the simulation, a sink schedule is written at the **&-SCH-SINk**[25] section**.** By entering a 2.0 for `Sink Factor`, the strength will be doubled at 02:00 o'clock. At 3:00 o'clock the sink is half of the start value at 01:00 o'clock. The schedule name (`SO3`) must start with an "S" and be followed by the name of the pollutant. To apply the schedule to a zone, the schedule name must also appear at the **&-NET-ZON** section (see above where it is attached to zone 2).

```
&-SCH-SINk schedules             29        --- OPTIONAL DATASECTION ---
  _____________________________________________________________
 |Schedule    |     Time                     | Sink Factor        |
 |*Name       |                              |                    |
 | (-)        |     (-)                      |      (-)           |
 |____________|______________________________|____________________|
  *SO3            1997jan01_02:00:00               2
                   1997jan01_03:00:00               0.5
```

The source schedule is similar to the sink schedule. The input is made under **&-SCH-SOUrce**[26]. The only difference is that now the schedule name must start with a "Q" instead of an "S".

The input of the outside air pollutants (in this case the constant pressure zones) is made under **&-SCH-POL**[27]. The schedule can be given any name, in this case the name is `outsair`. The five different pollutants' concentrations are given after the date. At 01:00

$_2$ concentration will increase.

[24] U.G 5.4.3.3
[25] U.G 5.5.7
[26] U.G 5.5.8
[27] U.G 5.7.4.3

```
&-SCH-POL outdoor concentration data  38    --- OPTIONAL DATASECTION ---
 _______________
|1.|DATASET NAME  |
|__|______________|
    outsair
 _____________________________________________________________________________
|2.| Time               |      Pollutant  Concentration                        |
|__|                    |______________________________________________________|
|                       |  No1      |  No2      |  No3      |  No4      |  No5      |
|    (-)                | (kg/kg)   | [kg/kg]   | [kg/kg]   | [kg/kg]   | [kg/kg]   |
|_______________________|___________|___________|___________|___________|___________|
  1997jan01_00:00:00      0.0012     0.00007       0          0           0
  1997jan01_01:00:00      0.0013     0.00007       0          0           0
```

The occupant description is provided in the **&-OCCUPAN**[28] section. This is an example of two different persons, one woman and one man. The second line (which must start with **&**) tells the program to use the occupants as CO_2 sources. The possibility to use the occupants as O_2 sinks also exists (just change `CO2` to `O2` or add `O2` at the same line after the d). COMIS will calculate the default value for the occupants' CO_2 source strength from the occupant description. If the occupant is a crowd of people of both sexes the word `MIX` can be used for the `Sex` entry.

```
&-OCCUPANt description          39        --- OPTIONAL DATASECTION ---
 ______________________________________________________________________
|No   |Sex      |Age      |Height   |Mass     |Activity|Cigarets   |Name       |
|(-)  |(-)      |(a)      | (m)     |(kg)     | (W/m2) | [1/h]     |           |
|_____|_________|_________|_________|_________|________|___________|___________|
  1     MALE      27        1.87      85        70         2         John_S
 & CO2 d
  2     WOMAN     23        1.75      60        50         0         Maria
 & CO2 d
```

Defaults							
-	MIX	20	1.725	64.24	77	0	-

To simulate occupants entering or leaving a zone or changing activity, an occupant schedule is used. When the simulation starts John S will be in zone 1, at 01:00 John's twin brother enters zone 1 and Maria enters zone 2. An occupant schedule must start with `OCC`. The input is made under **&-SCH-OCC**[29] and will look like this:

```
&-SCH-OCCupant schedules        31        --- OPTIONAL DATASECTION ---
 __________________________________________________________________
|Schedule   |    Time                    |   Zone     |  Activity Level |
|*Name      |                            |   ID       |  Factor         |
| (-)       |    (-)                     |   (-)      |     (-)         |
|___________|____________________________|____________|_________________|
*OCC1            1997jan01_00:00:00   1              1
                 1997jan01_01:00:00   1              2
*OCC2            1997jan01_01:00:00   2              1
```

To change the output from kg/kg to ppm add a conversion directive at the **&-PR-UNITS** section:

```
&-PR-UNITS
concent      kg/kg      ppm
```

[28] U.G 5.8
[29] U.G 5.5.9

The simulation and schedule time is specified as in previous examples and the words POL and CONC are added to run the pollutant model and to show the concentrations in the output.

```
&-PR-SIMUlation options          3
VENT
POL
CONC
DEFAULT
SCHED 1997jan01_00:00:00
START 1997jan01_00:00:00
STOP 1997jan01_03:00:00
```

This input at the **&-PR-OUTP**[30] section will write the concentrations at different times in the zones to a .CSO file. C1 is concentration of pollutant 1, S means store each value during simulation and 1,2 are the zones. The line "C1-T 1,2" will give the mean concentration values for pollutant 1 in zone 1 and 2.

```
&-PR-OUTPut options
C1-S 1,2
C2-S 1,2
C1-T 1,2
C2-T 1,2
```

Output

```
THE OUTPUT STARTS HERE!!
********************************************************************************

Input file:
ex6.cif
Model name:
Ex 6, pollutants, occupants, schedules
At time =  1997jan01_00:00:00 Wednesday  , interval =   3600 seconds
 NO poltrans    ERRORS REPORTED

  1 iterations with Solver=  5

================================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  1          -13.332           0.0241              -4.209E-11
  2          -26.664           0.0241                      0.


 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type        typ name  typ name  C      Pa        kg/s       kg/s
--------------------------------------------------------------------------------
   1 L1   CR1         sp 0Pa    zn 1        20.  1.33E+01    2.41E-02     0.E+00
   2 L2   CR1         zn 1      zn 2        20.  1.33E+01    2.41E-02     0.E+00
   3 L3   CR1         zn 2      sp -40Pa    20.  1.33E+01    2.41E-02     0.E+00
================================================================================

Pollutant transport output
==========================
Outside concentration ppm
```

[30] U.G 5.2.3

```
 ExtNr    CO2      O3
convers. 6.58E+05        6.03E+05

 1997jan01_00:00:00 Wednesday Pollutant Nr.  1(CO2)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s             kg/s        ppm
     1.00        1.00              1.00        0.658E+06
-----------------------------------------------------------
   1       0.         5.62E-06     1   0.            789.9
   2       0.         0.           0   0.            789.9

 1997jan01_00:00:00 Wednesday Pollutant Nr.  2(O3)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s             kg/s        ppm
     1.00        1.00              1.00        0.603E+06
-----------------------------------------------------------
   1       0.         0.           1   0.            0.
   2       0.         0.           0   1.E-07        0.
********************************************************************************

Input file:
ex6.cif
Model name:
Ex 6, pollutants, occupants, schedules
At time =  1997jan01_01:00:00 Wednesday  , interval =   3600 seconds
 NO poltrans    ERRORS REPORTED

  1 iterations with Solver=  5

================================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
---------------------------------------------------------------
  1          -13.332           0.0241              -4.903E-11
  2          -26.663           0.0241              -8.621E-12


 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type        typ name  typ name  C      Pa        kg/s       kg/s
--------------------------------------------------------------------------------
   1 L1   CR1        sp 0Pa    zn 1        20.  1.33E+01    2.41E-02     0.E+00
   2 L2   CR1        zn 1      zn 2        20.  1.33E+01    2.41E-02     0.E+00
   3 L3   CR1        zn 2      sp -40Pa    20.  1.33E+01    2.41E-02     0.E+00
================================================================================

Pollutant transport output
==========================
Outside concentration ppm
 ExtNr    CO2      O3
convers. 6.58E+05        6.03E+05

 1997jan01_01:00:00 Wednesday Pollutant Nr.  1(CO2)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s             kg/s        ppm
     1.00        1.00              1.00        0.658E+06
-----------------------------------------------------------
   1       0.         1.124E-05    1   0.            891.4
   2       0.         4.014E-06    1   0.            855.5

 1997jan01_01:00:00 Wednesday Pollutant Nr.  2(O3)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s             kg/s        ppm
     1.00        1.00              1.00        0.603E+06
-----------------------------------------------------------
   1       0.         0.           1   0.            20.91
   2       0.         0.           1   1.E-07        8.006
********************************************************************************

Input file:
ex6.cif
Model name:
```

```
Ex 6, pollutants, occupants, schedules
At time =  1997jan01_02:00:00 Wednesday  , interval =   3600 seconds
 NO poltrans    ERRORS REPORTED

  1 iterations with Solver=  5

===============================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  1          -13.332           0.0241              -7.691E-11
  2          -26.663           0.0241               5.807E-12


 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1   CR1        sp 0Pa    zn 1        20.  1.33E+01    2.41E-02     0.E+00
   2 L2   CR1        zn 1      zn 2        20.  1.33E+01    2.41E-02     0.E+00
   3 L3   CR1        zn 2      sp -40Pa    20.  1.33E+01    2.41E-02     0.E+00
===============================================================================

Pollutant transport output
==========================
Outside concentration ppm
 ExtNr    CO2      O3
convers. 6.58E+05        6.03E+05

 1997jan01_02:00:00 Wednesday Pollutant Nr.  1(CO2)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s             kg/s        ppm
     1.00         1.00              1.00        0.658E+06
----------------------------------------------------------
   1       0.         1.124E-05    1   0.            1027.
   2       0.         4.014E-06    1   0.            1068.

 1997jan01_02:00:00 Wednesday Pollutant Nr.  2(O3)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s             kg/s        ppm
     1.00         1.00              1.00        0.603E+06
----------------------------------------------------------
   1       0.         0.           1   0.            28.02
   2       0.         0.           1   2.E-07        15.89
*******************************************************************************

Input file:
ex6.cif
Model name:
Ex 6, pollutants, occupants, schedules
At time =  1997jan01_03:00:00 Wednesday  , interval =   0 seconds
 NO poltrans    ERRORS REPORTED

  1 iterations with Solver=  5

===============================================================================

Ventilation output
==================

 Zone-ID       pressure        totalflow           imbalance
               Pa              kg/s                kg/s
------------------------------------------------------------
  1          -13.332           0.0241              -8.982E-11
  2          -26.662           0.0241               1.263E-11


 link                  from      to       Tlink  Dp-link      fma1       fma2
 nr   name type       typ name  typ name  C      Pa        kg/s       kg/s
-------------------------------------------------------------------------------
   1 L1   CR1        sp 0Pa    zn 1        20.  1.33E+01    2.41E-02     0.E+00
   2 L2   CR1        zn 1      zn 2        20.  1.33E+01    2.41E-02     0.E+00
```

```
   3 L3   CR1        zn 2      sp -40Pa    20.  1.33E+01    2.41E-02     0.E+00
===============================================================================

Pollutant transport output
==========================
Outside concentration ppm
 ExtNr    CO2      O3
convers. 6.58E+05        6.03E+05

 1997jan01_03:00:00 Wednesday Pollutant Nr.  1(CO2)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
          kg/s       kg/s             kg/s        ppm
     1.00         1.00              1.00        0.658E+06
----------------------------------------------------------
   1       0.         1.124E-05    1   0.            1074.
   2       0.         4.014E-06    1   0.            1158.

 1997jan01_03:00:00 Wednesday Pollutant Nr.  2(O3)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
          kg/s       kg/s             kg/s        ppm
     1.00         1.00              1.00        0.603E+06
----------------------------------------------------------
   1       0.         0.           1   0.            30.44
   2       0.         0.           1   5.E-08        17.16

Steady state solution:
----------------------

 1997jan01_03:00:00 Wednesday Pollutant Nr.  1(CO2)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
          kg/s       kg/s             kg/s        ppm
     1.00         1.00              1.00        0.658E+06
----------------------------------------------------------
   1       0.         1.124E-05    1   0.            1098.
   2       0.         4.014E-06    1   0.            1208.

 1997jan01_03:00:00 Wednesday Pollutant Nr.  2(O3)
 Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
          kg/s       kg/s             kg/s        ppm
     1.00         1.00              1.00        0.603E+06
----------------------------------------------------------
   1       0.         0.           1   0.            31.69
   2       0.         0.           1   5.E-08        22.52


*******************************************************************************

Mean Values
===========

 KeyWord   Li/Zo-Name       Value         Unit
-----------------------------------------------
     C1-T  1             0.950260E+0003   ppm
     C1-T  2             0.965867E+0003   ppm
     C2-T  1             0.213840E+0002   ppm
     C2-T  2             0.108238E+0002   ppm
```